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Nos. 18 to 22 inclusive give some idea of the manner in which the chert is fractured.

Nos. 23 and 24 illustrate that which is often seen on a grand scale—alternating layers of chert and limestone. In specimen No. 3 there is strong indication of limestone having been silicified. The specimen shows three layers—an interior one, and two exterior ones. The interior one contains by far the greater number of fossils, and may thus have been more porous than the exterior ones. It would therefore have yielded more readily to silicifying waters, and it is possible that the whole of the specimen was at one time a limestone. The exterior portion is at present quite calcareous, even containing some carbonate. The theory advanced for the formation of great beds of chert, requires conditions quite favorable for such metamorphisms. They are not only possible, but altogether probable. But can anyone hold specimen No. 24 in his hand and say he thinks the chert in it was at one time limestone? Let me repeat: It only represents on a small scale that which exists on a large scale—alternating layers of chert and limestone. Specimens 21 and 22 are good arrow-head flint, but 22 has many crinoid stems in it.

No. 25 is a concretionary formation containing fossils. If this was formed in some cavity, how could those shells have been suspended in that cavity so that they would have been included in the central portion of the concretion? If those shells were originally included in limestone, why would such a peculiarly-shaped portion of that limestone have been silicified? If the limestone originally assumed this shape, why is it that similarly-shaped limestones are not found in localities where they have not been silicified? If they were fragments of limestone, water-worn until they became of this shape, why are the concentric layers so plainly marked? And why do some of them have small cavities along their major-axis? And why do some of them have two distinct centers around which the material has been collected, thus forming a true twin concretion?

FOSSIL WOOD.

BY ROBERT HAY, JUNCTION CITY, KANSAS.

Everybody in Kansas who has any collection of minerals or fossils, or merely a handful of so-called curiosities, is sure to have a piece of fossil wood. Inquiry develops the fact that the pieces were picked up on the high prairie, in a dry ravine, in a creek bed, on a river bottom, or in almost any conceivable situation. Some of these pieces are found *in situ*. They have been petrified at or near the spot where they were found by agencies now or very recently in operation. Elk creek, in Jackson county, yields petrifications in the form of iron pyrites; while a small tributary of McDowell's

creek, in Davis county, is possessed of such a quantity of calcareous matter that it produces petrifications of leaves and twigs in a few weeks or months.

The collectors of the curiosities will frequently tell you that the specimen you are examining is cottonwood, hickory, or sycamore wood. Some of them may be so, having been made by the more modern agencies referred to. But sometimes we pick up a piece that we call palm wood. This occurs most frequently on the western plains as far as Denver. We know that the palm has been petrified by no recent action. It has not grown here since the glacial epoch. Some of the larger specimens that are not palm are also as certainly not recent, but the geologic age to which they belong seems doubtful. We have a few facts that help to assign them to their true period.

The great advance that has been made in fossil botany through the discovery of numerous leaves in the rocks of the Dakota group and the lignitic series, has been as much through the labors of Professor Lesquereux as of any other man, or perhaps any two men; and yet in a communication from him, received by the writer during the past summer, the distinguished professor says he has no means of identifying fossil wood. Let us remember that the leaves and fruits we have plucked from Dakota forests are not associated with the trunks that bore them aloft in air, hence our ignorance of the structure of the various species of wood that must have existed. But it may be that we are on the confines of positive knowledge on the subject. The writer has in his possession a slab of sandstone from Ottawa county, which, besides other forms, has on it two leaves (not perfect, but very large) of *sassafras mirabile*, connected and separated by parts which are manifestly the remains of the twig or twigs on which the leaves grew. This stone, subjected to the examination of a competent *histologist*, would give us the structure of this Cretaceous *sassafras* in its woody fiber.

On the north line of Dickinson county, in a broad ravine, is a bluff of stratified sand almost solidified into stone, which has a tertiary facies, but which is overlaid by the fiery-looking ironstones of the Dakota. Out of this bluff, which has been worked as a sand quarry, some time ago there projected the base of the trunk of a tree, about two feet in diameter. Collectors have carried it away in parts, gradually digging into the face of the bluff, till there is now a horizontal excavation of about fifteen feet, and yet the top of the trunk has not been reached. The writer has portions of the wood and bark that show a diameter of about eighteen inches, from twelve feet in the cave. If this excavation is carried forward, branches and twigs may be reached, and if a leaf or carpel should be attached, we should have something from which to determine accurately at least one kind of Dakota wood. If such Dakota wood was petrified in more durable forms, it would not be improbable that in the localities of great denudation some of the harder specimens should survive the friction of ages. Some of the specimens of fossil wood we have seen, we are inclined to believe, are from the Dakota, though they are found on the high prairie, far away from the present Cre-

taceous areas. The rocks above Junction City are decidedly Permian, yet in little gullies among them we have found hard, siliceous ironstone pebbles that tell of the Dakota strata, long since vanished.

Some of the specimens of fossil wood are of siliceous limestone, with occasionally the silica very small in quantity, and the specimen might almost be described as hard chalk. This class has more numerous specimens than the kind we should be inclined to attribute to the Dakota. Till recently we inclined to refer these to recent action of water percolating through Cretaceous or Permian limestones, on recent wood imbedded in their crevices or in sedentary soils. Two specimens found last August have led to a change of this opinion.

In a ravine leading northward to the Saline river, in Russell county, we picked up one of these limestone petrifications that had such a resemblance to the Benton rocks around that it induced further search, which was rewarded beyond possible anticipation. On a projecting ledge, and forming part of a stratum above it that was considerably weathered, I observed some impressions of shells. The piece of which they formed a part, though large, easily broke off, and the under side was entirely petrified wood, the fibres and cells being shown in both longitudinal and cross-sections as distinctly as in the large Dakota tree of Dickinson county. Here was a piece of a log that floated in the early Benton Sea, over the enormous *Inocramus* bed, and becoming weighty with water, dropped down among shells, and in the lapse of æons since has become like them, a part of the solid limestone. We know it was the early Benton, because a little way further down the ravine we came to an outcrop of the soft, light-colored sandstone which often forms the upper horizon of the Dakota.

The facts we have narrated are significant. We believe they all point one way, viz., to the Cretaceous origin of most of the specimens of fossil wood found on our prairies. They also point to the desirability of submitting a series of these specimens to competent histological examination, so that by comparison with modern wood tissue the genera, if not the species, might be defined. It would be a beautiful result, but one that we should be led to expect, if such investigation referred the fossil woods to species of *platanus*, *sassafras*, *quercus*, *salix* and *laurus*, that have left their leaves impressed so fairly and in such multitudes on the sands of the Dakota shores.